CLAIMS

We claim:

1. A catalyst precursor comprising a compound represented by the formula: LMX_2 or the formula $(LMX_2)_2$ wherein:

each M is, independently, a Group 7, 8, 9, 10 or 11 transition metal;

L is, independently, a tridentate or tetradentate neutrally charged ligand that is bonded to M by at least three nitrogen atoms;

at least one of the nitrogen atoms is a central nitrogen atom;

at least two of the nitrogen atoms are terminal nitrogen atoms;

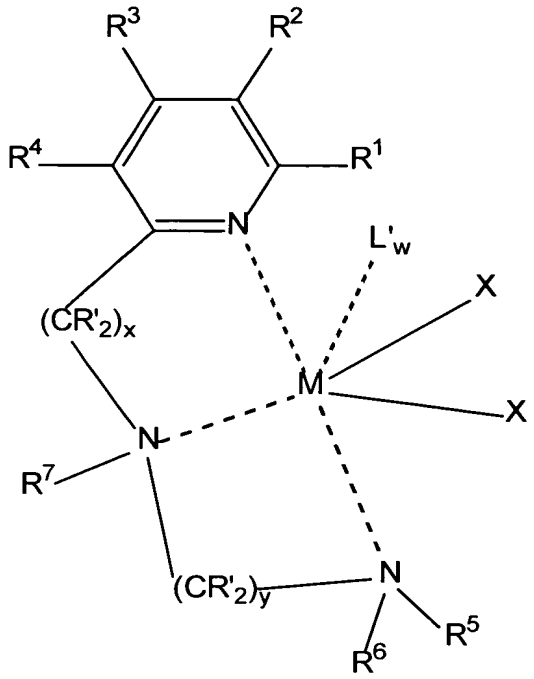
at least one terminal nitrogen atom is part of a pyridinyl ring;

at least one other terminal nitrogen atom is substituted with at least one C_3-C_{50} hydrocarbyl;

the central nitrogen atom is bonded to at least two different carbon atoms; and

X is, independently, an anionic monodentate ligand or two X may join together to form a bidentate dianionic ligand.

2. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

M is a Group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

C is carbon;

X is, independently, an anionic monodentate ligand, or both X groups together form a bidentate dianionic ligand;

R' is, independently, a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring comprising two R' groups on the same carbon, a polycyclic ring comprising two R' groups on the same carbon, a cyclic ring comprising two or more R' groups on adjacent carbons, or a polycyclic ring comprising two or more R' groups on adjacent carbons;

x is 1, 2, 3, or 4;

y is 1, 2, 3, or 4,

R^1, R^2, R^3 or R^4 is, independently, a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4, or a polycyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4;

R^5 is a hydrogen, a hydrocarbyl or a halocarbyl;

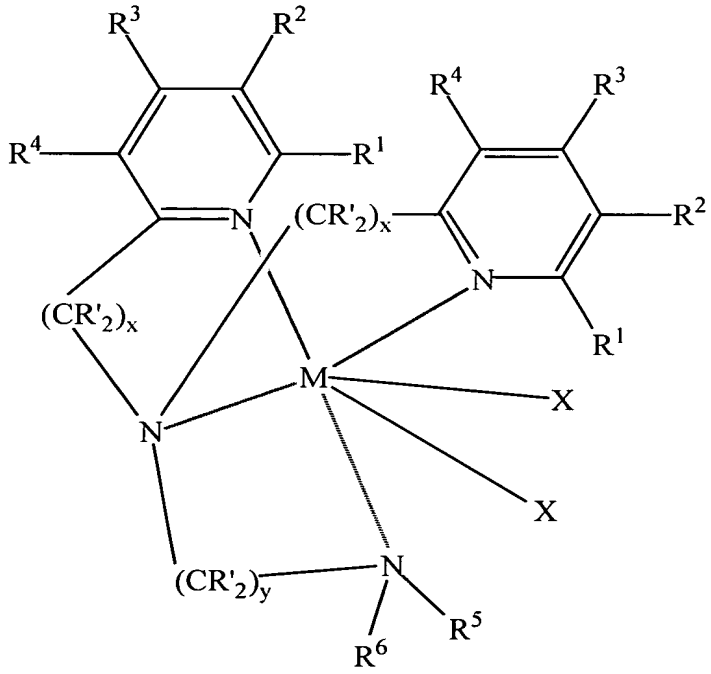
R^6 is a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl;

R^7 is a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl; a substituted hydrocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M, or a substituted halocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M;

L' is a neutral ligand bonded to M; and

w is 0 or 1.

3. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

M is a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

C is carbon;

X is, independently, an anionic monodentate ligand, or both X groups together form a bidentate dianionic ligand;

R' is, independently, a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring comprising two R' groups on the same carbon, a polycyclic ring comprising two R' groups on the same carbon, a cyclic ring comprising two or more R' groups on adjacent carbons, or a polycyclic ring comprising two or more R' groups on adjacent carbons;

x is 1, 2, 3 or 4;

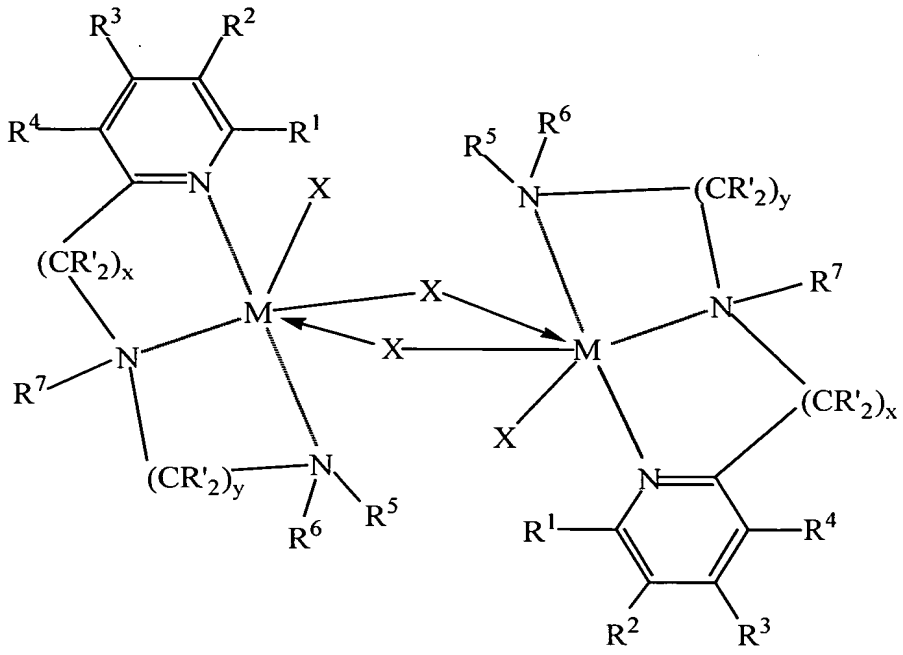
y is 1, 2, 3 or 4;

R^1, R^2, R^3 or R^4 is, independently, a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4, or a polycyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4;

R^5 is a hydrogen, hydrocarbyl or halocarbyl; and

R^6 is a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl.

4. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

each M is, independently, a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

C is carbon;

each X is, independently, an anionic monodentate ligand, or two X groups together may form a bidentate dianionic ligand;

R' is, independently, a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring comprising two R' groups on the same carbon, a polycyclic ring comprising two R' groups on the same carbon, a cyclic ring comprising two or more R' groups on adjacent carbons, or a polycyclic ring comprising two or more R' groups on adjacent carbons;

x is, independently, 1, 2, 3 or 4;

y is, independently, 1, 2, 3 or 4;

R^1, R^2, R^3 or R^4 is, independently, a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring

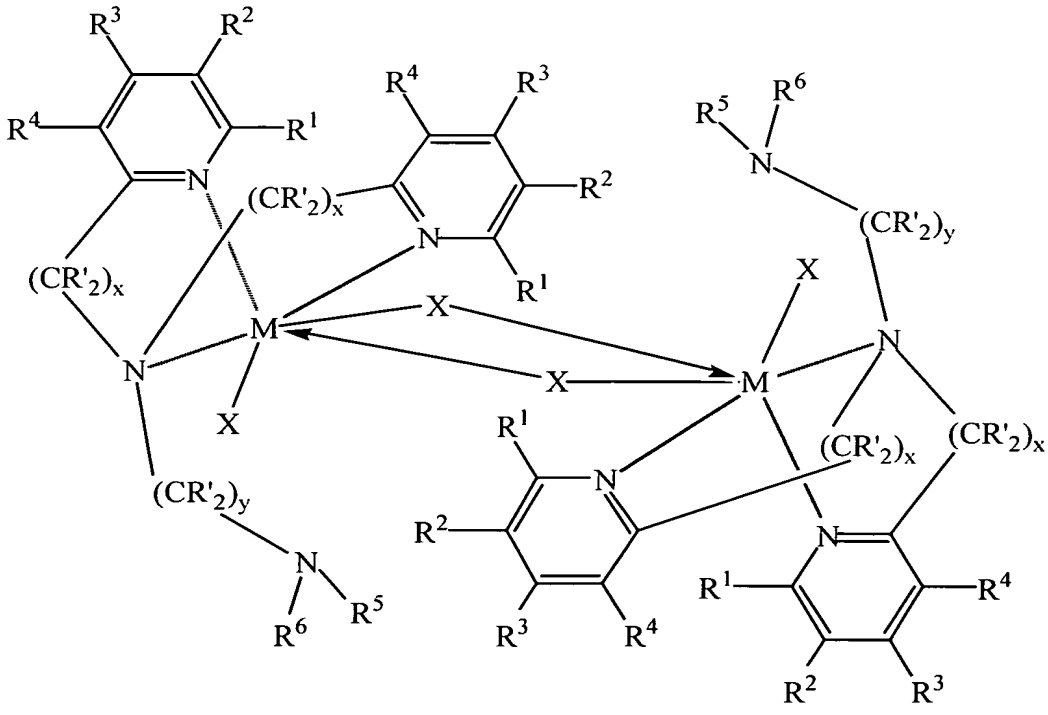
structure comprising two adjacent R^1, R^2, R^3 or R^4, or a polycyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4;

R^5 is, independently, a hydrogen, hydrocarbyl or halocarbyl;

R^6 is, independently, a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl; and

R^7 is a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl; a substituted hydrocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M, or a substituted halocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M.

5. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

each M is, independently, a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

C is carbon;

each X is, independently, an anionic monodentate ligand, or two X groups together may form a bidentate dianionic ligand;

R' is, independently, a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring comprising two R' groups on the same carbon, a polycyclic ring comprising two R' groups on the same carbon, a cyclic ring comprising two or more R' groups on adjacent carbons, or a polycyclic ring comprising two or more R' groups on adjacent carbons;

x is 1, 2, 3 or 4;

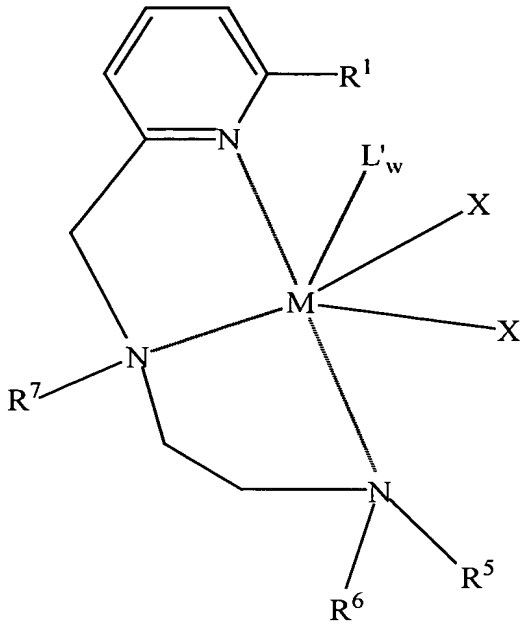
y is 1, 2, 3 or 4;

R^1, R^2, R^3 or R^4 is, independently, a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, a substituted halocarbyl, a cyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4, or a polycyclic ring structure comprising two adjacent R^1, R^2, R^3 or R^4;

R^5 is a hydrogen, hydrocarbyl or halocarbyl; and

R^6 is a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl.

6. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

M is a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

each X is, independently, an anionic monodentate ligand, or both X groups together may form a bidentate dianionic ligand;

R^1 is a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, or a substituted halocarbyl;

R^5 is a hydrogen, hydrocarbyl or halocarbyl;

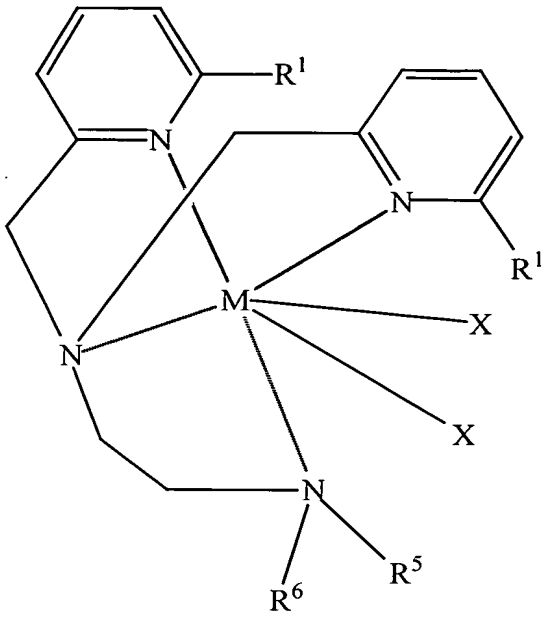
R^6 is a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl;

R^7 is a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl; a substituted hydrocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M, or a substituted halocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M;

L' is a neutral ligand bonded to M; and

w is 0 or 1.

7. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

M is a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

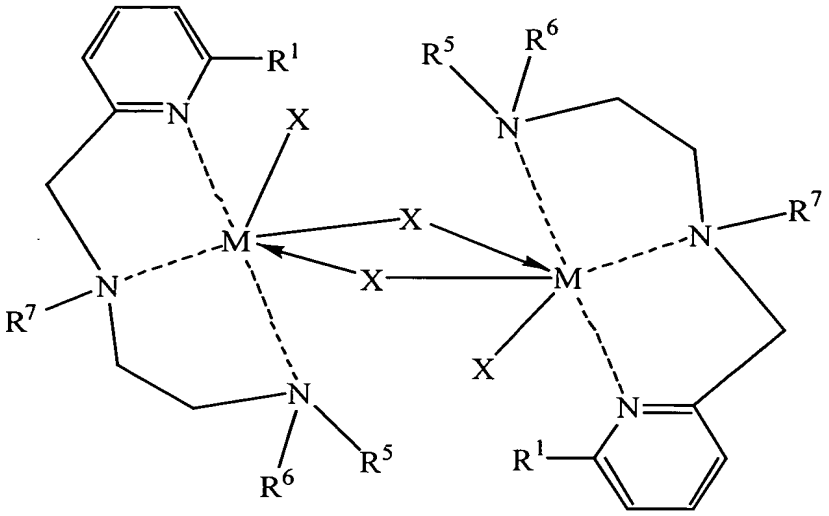
each X is, independently, an anionic monodentate ligand, or both X groups together may form a bidentate dianionic ligand;

each R^1 is, independently, a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, or a substituted halocarbyl;

R^5 is a hydrogen, hydrocarbyl or halocarbyl; and

R^6 is a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl.

8. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

M is, independently, a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

X is, independently, an anionic monodentate ligand, or two X groups together may form a bidentate dianionic ligand;

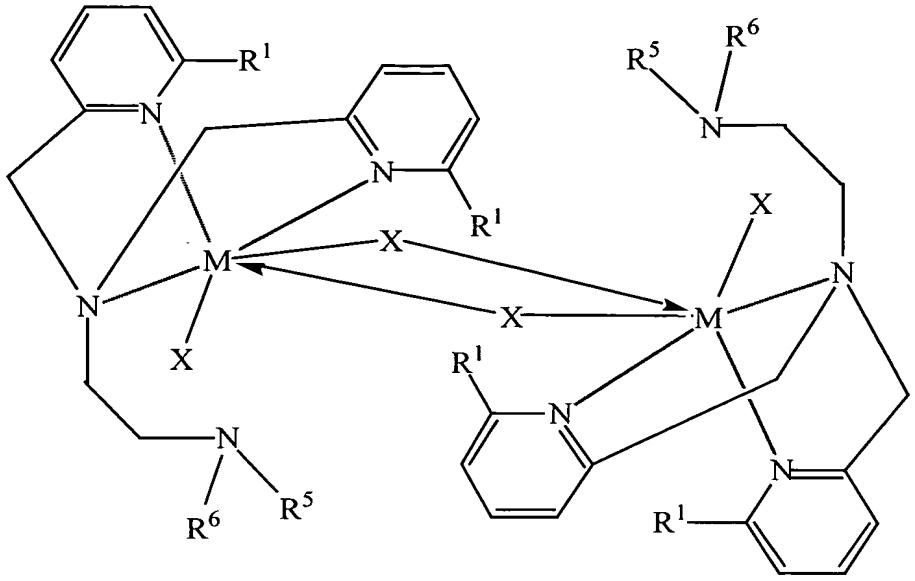
R^1 is a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, or a substituted halocarbyl;

R^5 is, independently, a hydrogen, hydrocarbyl or halocarbyl;

R^6 is, independently, a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl; and

R^7 is a hydrogen, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl; a substituted hydrocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M, or a substituted halocarbyl comprising a heteroatom, wherein the heteroatom is bonded to M.

9. The catalyst precursor of claim 1, wherein the compound is represented by the formula:



wherein:

M is, independently, a group 7, 8, 9, 10, or 11 transition metal;

N is nitrogen;

X is, independently, an anionic monodentate ligand, or two X groups together may form a bidentate dianionic ligand;

R^1 is a hydrogen, a hydrocarbyl, a substituted a hydrocarbyl, a halocarbyl, or a substituted halocarbyl;

R^5 is, independently, a hydrogen, a hydrocarbyl or a halocarbyl;

R^6 is, independently, a C_3 to C_{50} hydrocarbyl or a C_3 to C_{50} halocarbyl.

10. The catalyst precursor of claim 1, wherein M comprises a group 7, 8, 9, or 10 transition metal.

11. The catalyst precursor of claim 1, wherein M comprises one or more of nickel, cobalt, iron or manganese.

12. The catalyst precursor of claim 1, wherein X is a hydride, a hydrocarbyl, a substituted hydrocarbyl, a halocarbyl, a substituted halocarbyl, or wherein two X groups together are a hydrocarbdiyl, a halocarbdiyl, a substituted hydrocarbdiyl, or a substituted halocarbdiyl.

13. The catalyst precursor of claim 1, wherein two X groups are joined, and wherein the two X groups are independently selected from the group consisting of methylidene, ethylidene, propylidene, tetramethylene, pentamethylene, hexamethylene, butadiene, methylbutadiene, dimethylbutadiene, pentadiene, methylpentadiene, dimethylpentadiene, hexadiene, methylhexadiene, and dimethylhexadiene.

14. A catalyst system comprising a catalyst precursor according to claim 1, in combination with an activator.

15. A catalyst system according to claim 14, wherein the activator comprises an alkyl aluminum compound.

16. A catalyst system according to claim 14, further comprising a support.

17. The catalyst system of claim 16, wherein the support comprises silica.

18. The catalyst system of claim 16, wherein the activator is bound to the support prior to the activator being combined with the catalyst precursor.

19. A process to polymerize an unsaturated monomer comprising contacting the unsaturated monomer with the catalyst system of claim 14.

20. The process of claim 19, wherein the unsaturated monomer comprises ethylene, propylene, a butene, a pentene, a hexene, a heptene, an octene, a nonene, a decene, a dodecene, or a combination thereof.

21. The process of claim 19, wherein the unsaturated monomer further comprises one or more dienes.

22. A process to oligomerize an unsaturated monomer comprising contacting the unsaturated monomer with the catalyst system of claim 14.

23. The process of claim 22, wherein the unsaturated monomer comprises ethylene, propylene, a butene, a pentene, a hexene, a heptene, an octene, a nonene, a decene, a dodecene, or a combination thereof.

24. The process of claim 22, wherein the unsaturated monomer further comprises one or more dienes.